No. 26.

A Dissertation

on the

Proximate Cause

of

Inflammation

Philadelphia:

1812

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A Dissertation
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The present is an age so replete with discoveries in science & with improvement in the arts, that philosophers are every day becoming less abhorrent at innovation; & the inventor of a new theory stands a much better chance now, than formerly of obtaining a hearing & of escaping persecution. We have been so much accustomed to smile at the errors, both speculative & practical, of the great men that have gone before us, that we hardly dare to enlist under the banners of any master, however splendid his genius, or extensive his learning. [illegible] fade away, & he & his opinions are quite [illegible] forgotten. New facts are observed; [illegible] are made, which set three fourths of the medical world to wondering, & [illegible] speculating. At length a fus[illegible] mortality steps forward with a [illegible] theory, [illegible]

— "Struts his hour upon the stage,
And then [illegible] he's no more."—

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Such will ever be the state of things, when the truth of any theory, or system can only be infered from observation, which may have been incorrect, or from experiments, which may have been carelessly conducted or partially stated. It is from this circumstance that so many disputes have arisen about the proximate cause of inflammation. From Hippocrates down to the present time it has excited much interest, & given rise to much speculation. Many of the theories on the subject are absurd, & some of them so far from correct, that they ought not to be mentioned for the sake of their authors. The false notions of such men as Boerhaave & Cullen, like the unavoidable failings of the virtuous & the good, ought to be blotted from the memory of every philosopher.

The question now is, whether inflammation depend on an increased, or diminished action of the vessels of a part inflamed. Those, who favour the idea of increased action, maintain, that the arteries of an inflamed part not only contract, but dilate their diameters beyond

V. Pl.

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what is natural to them in a healthy state. By this increased dilatation, a greater quantity of blood passes through them in a given time than was wont to be the case; those minute branches, which before carried only the colourless part of the blood, now become visible from admitting the red globules of that fluid. In this manner the part inflamed becomes tumified, & there exists in it pain, with increased redness & heat. This, if I mistake not, was the notion entertained upon the subject by Mr John Hunter, Clarum & venerabile nomen! But it is concluded, in opposition to such high authority, that inflammation depends, not on an increased, ~~augmented or increased~~ action of the blood-vessels, but on a diminished proportion of the area of the capillaries to the vis a tergo; in other words, there is an accumulation, or partial stagnation of blood in the parts inflamed. If ~~that~~ this, instead of shewing an increased action, shows the direct contrary, a diminished action.

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This is the idea I have ever entertained upon the subject, suggested, not by books, but by observation. I mention this, not because I wish to lay any claim to originality, but to convince my much honoured instructors ~~that~~ it is not from any want of deference to their opinions, that, I have ventured to express my sentiments on so interesting a subject as that of the present dissertation.

That the phenomena of inflammation depend on diminished, rather than on increased action of the blood-vessels, I infer,

I. From the anatomy of the parts concerned in inflammation,

II. From some of its remote causes,

III. From some of its most successful modes of treatment, &

IV From the experiments of Dr Wilson & of Dr Stevens

I. It is now proved that, the arteries are not mere elastic tubes, through which the blood passes to every part of the body, like water through a hose.

V. Pl.

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Since the heart, they are endowed with muscularity; so that, independent [illegible] they can contract their dimensions upon application of an irritant, or [illegible] stimulus of [illegible] In proportion as the arteries recede from the great centre of circulation, this muscularity [illegible] to increase, as it [illegible] doubtless intended to compensate with [illegible] in transmitting blood to every part of the body. Performing a similar office with the heart, we must suppose it [illegible] a similar manner. But, [illegible] tion of the heart? It is generally agreed that, both the ventricles are actually provided with valves. They allow themselves to be extended to a certain extent, [illegible] their irritability, contract upon the [illegible] of blood forced into them [illegible] is a tergo. I have [illegible] that, the muscles of [illegible] are endowed with [illegible]

7 Pl

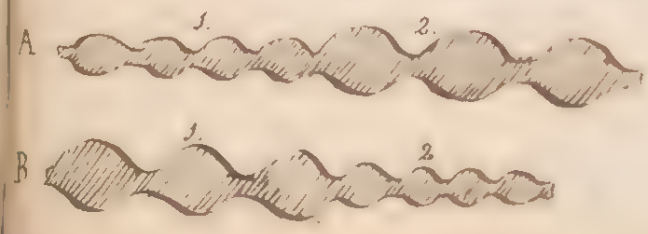
There is no need of supposing such a power. We are to admit no more causes of things, than are sufficient to explain appearances. It is, then, to the action of the arteries. Have we any reason to believe that the action of the arteries is different in certain cases from force, with which the blood is sent from the left ventricle of the heart, is so sufficient to explain the cause of the [illegible] commencement; the usual [illegible] tion of this part of the arteries, added [illegible] ves a large, is sufficient to distend a second, the muscular power of the arteries, so [illegible] to the motion [illegible] al system. There is then no [illegible] or a double action of the [illegible] even a further [illegible] that, [illegible] would be attended with [illegible] uneasiness, if not with fatal [illegible] consequences. It would not [illegible]

[illegible] in the arteries as, [illegible]

T. Pl

[illegible] the diameter [illegible] recorded [illegible] the [illegible] of the [illegible] of [illegible] of [illegible]. Suppose portions [illegible] of [illegible] respectively [illegible] A & B [illegible]. It is evident that the [illegible] of blood in portion 1 of fig. A can never fill portion 2 of the same figure. Since if we suppose portion 2 to be expanded into greater dilatation than portion 1, it will pass a vacuum. For, following the circle, if portion 1 of B [illegible] to be greater than portion 2 of the same, it is evident that, if portion 1 [illegible] dilate so as to admit all the blood in portion 1, there will be a regurgitation. [illegible] by the past of the figure, if [illegible] action of dilatation will not [illegible] recorded volume of blood in a [illegible]

Since muscles, as far as we [illegible] themselves on the application [illegible]



T. R.

[illegible] shed, what should [illegible] applied to your
[illegible] contractions, [illegible] the [illegible] beyond the [illegible]?
The common suppose that the [illegible] stand, [illegible]
[illegible] the [illegible] talon, all, [illegible] [illegible]
[illegible] to [illegible] the [illegible]
to look [illegible] at the last; [illegible]
[illegible] all [illegible] [illegible]
it [illegible] the [illegible] of physiology."

A note Glaucoma was observed the, [illegible]
[illegible] talon, then [illegible] supposed [illegible]
case, we must [illegible] [illegible] as [illegible]
[illegible] is a weak reasoning. [illegible]
[illegible] contractile [illegible] supposed: But, [illegible]
[illegible] supposes [illegible]
[illegible] who supposes it.
there [illegible] apparent [illegible]
that, the biceps muscle [illegible]
of [illegible], [illegible]
the antagonists & biceps [illegible]
purpose? And is not the [illegible]

T. R.

[illegible] analogy lies all against an action of dilatation [illegible]

The action [illegible] of the arteries, then, resembles in every respect that of the heart; &, being endowed with a muscular coat, must be subject to the laws of muscularity. Contractility is one of the most striking characters of a muscle. If, then, contractility be increased, the application of a less stimulant will be necessary to excite it into action, & vice versa. If, then, the contractility of an artery be increased, it will [illegible] upon a much less volume of blood [illegible] ordinary state of expectability. Whenever, then, we observe the pulsations in any part of an artery to be fuller than ordinary, & full [illegible] the same action on an opposite side of [illegible], although the pulsations of the one [illegible] not perfectly synchronous with those of the other, [illegible] that the former has lost [illegible] contractility, or that, in other words, it [illegible] under indirect debility. Now, when it [illegible] as it has to push forward a [illegible] it is evident that it cannot act to the [illegible]

T. R.

extent even if it act with the same force as in a healthy state: of course, there will be a retardation, or partial stagnation of blood. This retardation is favoured, or, at least, sometimes opposed, by diminished action in the veins; for, there is such an intimate connexion between the arteries & veins, that, whatever tends to diminish the power of the one, must produce a similar effect upon the other. I know it is supposed by some that, the veins have little or no action, & that, the principal cause of the passage of the blood in them is the combined action of the heart & arteries. "But, as Richerand observes, the propulsive force communicated to this is lost & obliterated in the system of capillaries, & does not extend to the veins. The action of their own coats, assisted by some accessory powers, is sufficient to carry it back to the heart. In capillary [illegible], in a similar manner, in [illegible] veins & the lymphatics, [illegible] work [illegible] the [illegible]

T. R.

From this account of the anatomy of the parts in which inflammation is seated, it is evident that, increased action will not account for the phenomena of inflammation. It will not account for the turgescence of an inflamed part. We cannot suppose increased action of the arteries in, at least, a majority of cases, without supposing also an increased action of the veins & lymphatics. In this case the motion of blood ought rather to be diminished than increased.

II I come now to notice some of the remote causes of inflammation. However it may be produced, & wherever it may be seated, inflammation must be considered as a [illegible] It is quite unnecessary to [illegible] to remote causes, or to dwell upon the [illegible] mode of action. Inflammation [illegible] divided, with respect to the [illegible] into constitutional & foreign. [illegible] inflammation may arise [illegible] action of the whole internal system [illegible] the [illegible] upon the [illegible]

T. R.

of a particular part; as, from the [illegible] of phenomena. [illegible] the humoral pathologists [illegible] might [illegible] inflammation [illegible] ever [illegible] any explanation [illegible] to a part [illegible] mechanical [illegible]. I select for my present purpose the chemical causes Heat & Cold. It is not strange that the [illegible] applications [illegible] & such [illegible] the [illegible] place [illegible] inflammation. Heat, we know, is a most active element, & [illegible] imagine [illegible] thus [illegible] that the presence [illegible] immediately [illegible]. & that the [illegible] ~~[illegible]~~ [illegible] plication [illegible], in a great [illegible] to be considered [illegible]. Hence, we have so much [illegible] "drawing out the heat" [illegible] are [illegible]; but these [illegible]s.

The proximate cause of [illegible] action [illegible]

T. Pl.

sets. It is a law of the animal economy that, the application of violent stimuli to any part shall be succeeded by a direct debility of the part. Daily experience shows us that, every time the system is roused above the grade of healthy excitement, she is obliged to retrace her steps & descend below the level, that she does with quickness in life in proportion, as the excitement is more or less considerable above the healthy standard. It does it sometimes so instantaneously that it is often difficult to determine whether it is or not any excitement has been produced. How many disorders have arisen out of the pernicious effect of opium & digitalis! These are now ascertained to be powerful stimuli. I perhaps, the very same persons, who are convinced that they both act [illegible] will contend that increased action is the immediate effect of the powerful stimulus that. But, it seems as [illegible] to me, that the stimulating effect [illegible] to run an fast in [illegible] effect [illegible] been withdrawn, as to [illegible] experiment a day or two [illegible]

P. R.

[illegible] of laudanum. The application of heat to the body, I conceive, is perfectly analogous to that of every other stimulant. It produces, when carried to a certain extent, indescribable [illegible] in all its forms, even death: decidedly by [illegible] are decided into four degrees:

"1st In the first, there is [illegible] a slight [illegible] without swelling, and a gentle inflammation also is excited, but soon subsides."

"2d In the second degree the redness [illegible] is attended with swelling, the pain is [illegible] inflammation is acute, but [illegible] in resolution."

"3d In the third degree vesicles [illegible] a clear or yellow fluid are [illegible] gradual manner, the pain is [illegible] suppuration can seldom be prevented."

"4th In the fourth degree the [illegible] is mortified. This happens either [illegible] the accident [illegible] death after."

Increased action in all the [illegible] plans immediately [illegible] 1st the [illegible] preparation [illegible]

T. R.

[illegible] the [illegible] of sensibility. In flam-mation seems [illegible] at least to depend [illegible] on a [illegible] [illegible] of the vessels.

[illegible] seems to [illegible] [illegible] the [illegible] [illegible] [illegible] strength [illegible] proportion to [illegible] [illegible] [illegible] of blood. [illegible] [illegible] [illegible] [illegible], & ready [illegible] [illegible] [illegible] [illegible] [illegible]. Accordingly [illegible] [illegible] [illegible], the [illegible] [illegible] [illegible] [illegible] as [illegible] the [illegible] [illegible] of the [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] by [illegible], & debased by [illegible]

[illegible] of the [illegible] the effects of [illegible] [illegible] sedative upon the blood vessels, it [illegible] [illegible] to shew in what manner [illegible] [illegible] is produced by the direct [illegible] [illegible]. It [illegible] known that the [illegible] [illegible] suddenly & to a great extent [illegible] [illegible] sensation by the same effects [illegible] [illegible] [illegible] it would have [illegible]. [illegible] [illegible] suffered very [illegible] [illegible] [illegible] to his hand a piece of frozen [illegible]. [illegible] [illegible] [illegible] was [illegible] [illegible] [illegible] [illegible] [illegible]

T. R.

quantities of fire had fallen upon his hand, & the same effects followed. The Chilblain is known to almost every one by sad experience. It is produced by the sudden warming of a cold part or the sudden cooling of a heated part. Like the inflammation of burns it has four degrees, & sometimes ends in mortification. It would seem not a difficult task to prove, in all these cases, to be the proximate cause of the inflammation; since cold is a sedative, it must, therefore, produce direct or indirectly. Inflammation, however, does not succeed as the immediate effect of the application of cold to the body. Increased action of the capillaries is the first stage, it is produced either by the application of heat or some other stimulus to the increased irritability. Debility [illegible] succeeds, it is followed by inflammation [illegible] time is prompt in the application, & also [illegible] increase may be accomplished [illegible] short time, often almost instantaneously; [illegible] case with the proper [illegible] stimulus. That this is the [illegible]

T. Pi

I infer from the effect of sudden heat applied to a large part, subject, by acting on the nervous tubes, expectable prostration almost instant mortification. Here, the part is prostrated as suddenly, as the whole system would have been in a healthy state by a violent stroke of electricity. Had the part been less expectable the very same stimulus would only have produced inflammation. Both effects however are prevented by the medical application of so as to expand & relaxing & to produce the effect of equilibrium.

But, then, is the same inflammation results from the [illegible] agents Heat & Cold. [illegible] necessary, how the same effects could [illegible] operation of mechanical causes. [illegible] are all a unit in their operation, it [illegible] all be explained upon the [illegible]

III That the position I have [illegible] the proximate cause of inflammation [illegible] infer, further, from the [illegible] motion that have been [illegible] fact, more especially, from the opposed motion

T. Pr

of treating burns & scalds. Mr B. Bell says that, in some cases emollients give relief; but, in general, astringent applications are the best. He passes particularly strong terms on brandy or alcohol. According to him the patient should be immersed in spirits, & if this cannot be done, soft old linen should be applied constantly to the part. The Glycerum used was [illegible] for placing the patient, in cold weather, near a fire. In cold water & ice of the Gas & Earl and also as astringents. Mr Pe[illegible] the tri[illegible] apples, recommends holding the part to the fire. If that cannot be d[illegible] that we should resort to the st[illegible] lamb's gas, rectified spi[illegible] in the essential oils. He also [illegible] which he applied spirits to [illegible] foot of a frog, the inflam[illegible] blood-vessels which [illegible] rally dilated [illegible] seize & the blood [illegible] ceased to flow, [illegible]

T. 6

accustomed celerity. How completely inapplicable are these facts upon the principle of increased action!

Inflammation from cold is also treated on the stimulating plan. It is recommended to wet the parts affected with spirits of wine & tincture of myrrh. ~~[illegible]~~, ~~[illegible]~~ of ol. terebinthe. & balsam copaiva in equal parts is a celebrated remedy. A mixture of [illegible] rectified spirits of wine has also been [illegible] highly recommended.

But, the stimulating plan of treat[illegible] it is not confined to the above species of inflammation. Its good effects are more [illegible] in erysipelas. I have tried it [illegible] on myself, but on others. In a [illegible] the progress of the inflammation [illegible] stopped & finally removed. My [illegible] to pour about half a pint of [illegible] a little height upon the inflamed part [illegible] them to wet it with the spirits. [illegible] I soon reduced an erysipelatous inflammation, that was extending [illegible]

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up the leg. My friend Dr R. after much persuasion, at last permitted me to try the same experiment on himself. He had for some time been troubled with erysipelas in the face, which he had endeavoured, in vain, to remove. The spirits immediately relieved him, & he was well in two days. It is unnecessary to enlarge further on this point. It is corroborated by Dr, "Wens "a single fact shewing that, local st "uli are our first & best applicatio to "ed parts, is of itself a basis of reasons a "the principle doctrines on this sub "t."

IV. What has been said in favour of "ished action as the proximate cause of "mation receives additional support from "periments of Dr Wilson. He says, "the inflammed m had "now in the web of a frog's foot. "a m ap "plied to it a microscope "of "of the part greatly dilated & "the blood extremely turgid "ces where inflam. ation was "altogether. It was evident that, a

T. 6.

"was greatest, the vessels were most dilated & the
"motion of the blood slowest. The distention of the
"vessels, which, in the healthy state, admit only
"the colourless part of the blood, was apparent;
"for in inflamed parts a much greater number
"of ~~[illegible]~~ vessels admitted the red particles
"than in the sound, & the interstices of the ves-
"sels appeared more opaque, probably from
"the enlargement of innumerable small
"still too small to admit the proper parts of
"the blood."

"While I was viewing the inflamed [illegible]
"and that, if I could suspend or dim[illegible]
"side of the arteries, I could then see [illegible]
"While this were, I milked the inflam[illegible]
"distilled spirits, at the same [illegible]
"of the concentrated tinge of it [illegible]
"expansion the spontaneous [illegible]
"blood in all the vessels, except [illegible]
"inflamed parts, began to [illegible]
"more velocity; & in proport[illegible]
"& the vessels became [illegible]
"the red seemed pale, & it [illegible]

T. B.

"spaque."

Sufficient evidence was then received in the first & last of a fish. The experiment with opium was repeated, & with the same result. The experiment was next made on the intestines of a rabbit. If really the same appearances were observed here as in the two former cases.

A part of Dr Wilson's experiments he then repeated for Dr Stevens; & he also found that it nourished & not increased action of the intestines. To an impartial mind, the results must appear perfectly satisfactory. An objection has been urged against a late Reviewer. He does not, as the veracity of Dr Wilson or of the other gentlemen would lead one to have so accurately described selected transparent objects, the stomach that might take place in the ashes, could they actually moved slower in the original second part of the frog, as this is a serious objection, & may

experiments too, are so serious a, terms of our imports.

gentlemen have made use of are to be taken
in their literal sense. But, we are not to
look upon Dr Nelson & Dr Stevens, as a second
Falstaff who pretended to discern "three rows
"together hanging on the dal queen," when it was
so dark he could not see his hand before
him. They meant to say, merely, that the
flamed part of the frogs was becoming less
perfect, but still not so opaque as to
pletely impervious to light. Of
both saw what they have said is;
reason: In the experiment made
on the intestine of a rabbit, the
to trust his own eyes, but after
inflamed part himself, rather than
sumation of Mr Branston,
acquainted with his view
experiment Mr Brande
supposed to have given
concert of what the observers
Dr Nelson has given in
~~[illegible]~~ is intellect
similar experiments

[illegible] too, are to be viewed as terms of our imperfect-

T. H.

I must confess that, I am not perfectly satisfied with Dr Stevens's definition of the proximate cause of inflammation. In one part he has gone too far & in another not far enough. I do not understand how debility & morbid action can exist in the same part at the same time. Dr Stevens, too, should have said that inflammation arises from absolute as well as relative debility of the small vessels. – It is, however, a different thing to give a very concise definition of the proximate cause of a disease, Ur usually mean by it the disease itself, & therefore, it is necessary to enumerate all those particulars which constitute it what it is. If this be true, inflammation, or what is the same thing, the proximate cause of inflammation, may be defined.

That state of a part, in which there is absolute or relative debility of its smaller vessels, inviting the retardation, or partial stagnation of a greater quantity of blood, than is natural to it in a healthy state.

Especially too, are to be viewed as terms of one import.

I have thus endeavoured, & I hope it will not be thought presumptuously, to disprove the doctrine of increased action. After all, it may be asked, of what use is all this contention about the proximate cause of inflammation? It has been successfully treated by the followers of Boerhaave, & of Cullen & of Hunter, & if we should chance to be right, & they be wrong its mode of treatment must continue as it found it. This may, perhaps, be true: But, in reply, I will say that many a blind man has found his way, by groping & by blundering, for years, perhaps, into every lane, alley, & street of London or Philadelphia, but, should he then find the light, how grateful of all at once he should be able to proceed quicker & surer by the blessed light of Heaven? And shall any be indifferent about the blessed light of true principles?

Finis.